

Public Workshop to Discuss Reducing Emissions from Diesel-Fueled
Cargo Handling Equipment at Intermodal Facilities

Port Equipment Yard Truck Emission Reduction Demonstration



May 18, 2005

Sacramento, California

California Environmental Protection Agency



Air Resources Board

Demo Program Overview

- ◆ Combined POLA, POLB & ARB Project
- ◆ Program Components
 - Offroad certification type emission testing
 - Data logging for duty cycle data
 - In-Use emissions data (field testing)

Demo Program Components

- ◆ Certification Type Emission Testing
 - Yard truck chassis offroad certification type testing (Modified C1, 8 mode steady-state)
- ◆ Data Logging
 - Review existing duty cycle information
 - Perform additional data logging
 - 3 terminals, 12 trucks total
 - Yard duty and ship load/unload duty
- ◆ In-use Emission Testing
 - In-Use driving (simulated yard and loading duty)
 - Ride-along or pull-along emission measurement system

Certification Style Emission Testing

- ◆ Offroad Certification Type Emission Testing for Direct Comparison
 - 2004 onroad vs. 2004 offroad engines
 - Additional baseline emissions data
 - Alternative fueled yard trucks
LNG and Propane
 - Emulsified diesel

Emission Test Matrix

Chassis Dyno Testing							In-Use Testing (Ride-along)
Engine Type	Engine Size (Cummins)	Model Year	CARB Diesel	ULSD	Emuls. Diesel	Alt. Fuel	(Tentative Plan)
Baseline (Typical In-use) Equipment	5.9L	2000	1		1		1
	5.9L	1997	1		1		
	8.3L	2001 or 2002	1		1		
New Off- Road Engine	QSB 5.9L	2004		1			1
New On- Road Engine	ISB 5.9L	2004		1			1
Propane Fueled Engine		2005				1	1
LNG Fueled Engine	8.3 L	2005				1	1

Offroad Test Cycle- 8 Mode C1

Table of test modes and weighting factors

Speed	Rated Speed					Intermediate Speed					
Torque	100	75	50	25	10	100	75	50	25	10	Low Idle
C1	15%	15%	15%		10%	10%	10%	10%			15%

Modified Test Cycle- 8 mode

Modifications to the C1 test cycle

- ♦ Increased the engine speed for the intermediate speed modes
 - Necessary to increase wheel speed during testing to achieve power levels in dynamometer
- ♦ Used wheel horsepower instead of engine horsepower in emission factor calculations
 - Wheel power is lower than engine power due to losses in transmission, etc.
 - May result in higher measured emission factors compared to certification data
 - Plan to use ECM data to estimate engine horsepower and recalculate emission factors

Offroad Certification Type Testing

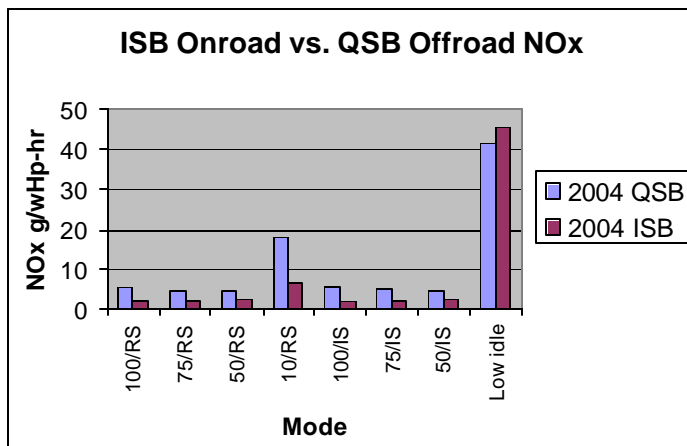


Offroad Certification Type Testing

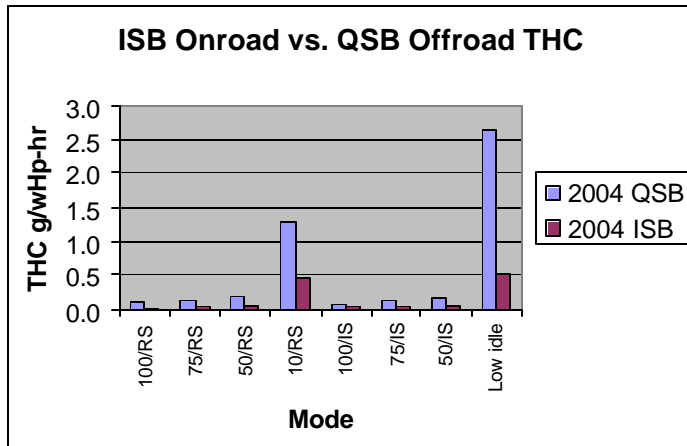
- ♦ Testing Performed By UC Riverside CE-CERT
- ♦ Using Mobile Emission Laboratory (MEL)
- ♦ Chassis Dynamometer at Johnson Machinery
- ♦ Trucks supplied by POLA terminals



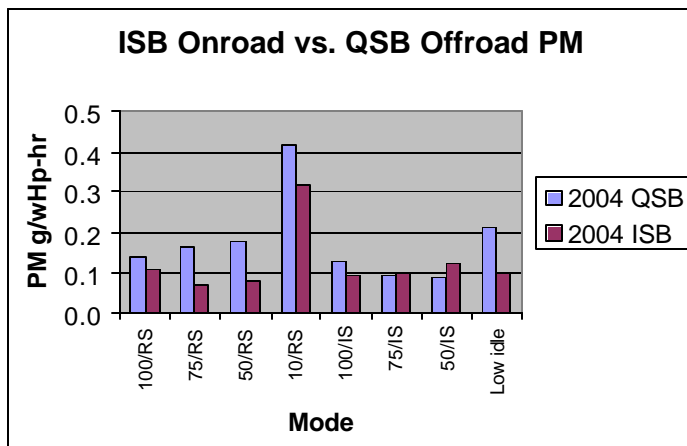
Preliminary NOx data '04 ISB Onroad vs. '04 QSB Offroad



Preliminary THC data '04 ISB Onroad vs. '04 QSB Offroad



Preliminary PM data '04 ISB Onroad vs. '04 QSB Offroad



Certification Information

'04 ISB Onroad vs. '04 QSB Offroad

Certification Information

	Tier 2 Nonroad Emission Standards	2004 QSB Certification Levels (Nonroad C1)	On Highway Emission Standards (2004)	ISB 2004 Certification Levels (On-hwy HDDE)
	g/bhp-hr	g/bhp-hr	g/bhp-hr	g/bhp-hr
NOx +NMHC	4.8	4.25	2.4	2.3
PM	0.15	0.10	0.10	0.10

Preliminary Results

'04 ISB Onroad vs. '04 QSB Offroad

Weighted Emission Factors (modified C1 8 mode)

	2004 QSB Offroad	2004 ISB Onroad	% Difference
	g/whp-hr	g/whp-hr	
THC	0.16	0.05	69.4
NOx	5.54	2.45	55.8
PM	0.14	0.10	30.0

Next Steps

- ♦ Complete remaining certification type testing (May-June)
- ♦ Finalize data logging protocol and complete data logging
- ♦ Finalize In-use emission testing protocol and perform in-use testing

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